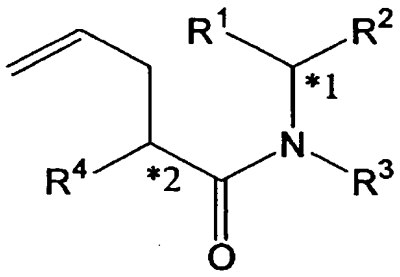
CLAIMS

1. A 2-allylcarboxamide derivative compound represented by the following formula (1);



(1)

wherein R^1, R^2 and R^4 each independently represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms, R^3 represents a hydrogen atom, a substituted or unsubstituted alkyloxycarbonyl group containing 2 to 20 carbon atoms, a substituted or unsubstituted aryloxycarbonyl group containing 7 to 20 carbon atoms or a substituted or unsubstituted aralkyloxycarbonyl group containing 8 to 20 carbon atoms, and *1 and *2 each indicates that the carbon atom marked therewith is an asymmetric carbon atom.

2. The compound according to Claim 1,

wherein R^1 is a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms.

3. The compound according to Claim 1,

wherein R^1 is a group selected from among phenyl group, 4-methylphenyl group, 4-methoxyphenyl group, 3-methoxyphenyl group, 4-nitrophenyl group, 4-chlorophenyl group, 4-bromophenyl group, 1-naphthyl group and 2-naphthyl group.

4. The compound according to any one of Claims 1 to 3,

wherein R^2 is a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms.

5. The compound according to any one of Claims 1 to 3,

wherein R^2 is methyl group.

6. The compound according to any one of Claims 1 to 5,

wherein R^3 is a hydrogen atom.

7. The compound according to any one of Claims 1 to 5,

wherein R^3 is phenyloxycarbonyl group.

8. The compound according to any one of Claims 1 to 5,

wherein R^3 is isopropyloxycarbonyl group.

9. The compound according to any one of Claims 1 to 8,

wherein R^4 is a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms.

10. The compound according to any one of Claims 1 to 8,

wherein R^4 is n-hexyl group.

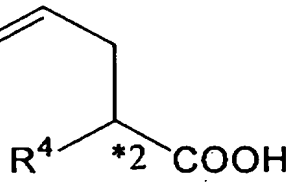
11. The compound according to any one of Claims 1 to 10,

wherein the asymmetric carbon atom marked with *1 has the R-form or S-form absolute configuration.

12. The compound according to any one of Claims 1 to 11,

wherein the asymmetric carbon atom marked with *2 has the R-form or S-form absolute configuration.

13. A process for producing an optically active 2-allylcarboxylic acid represented by the following formula (5);

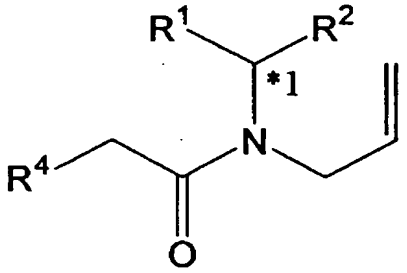


(5)

wherein R^4 represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms and *2 indicates that the carbon atom marked therewith is an asymmetric carbon atom;,

which comprises:

(a) reacting a carboxamide compound represented by the following formula (2);



(2)

wherein R^1 and R^2 each independently represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms, R^4 is as defined above and *1

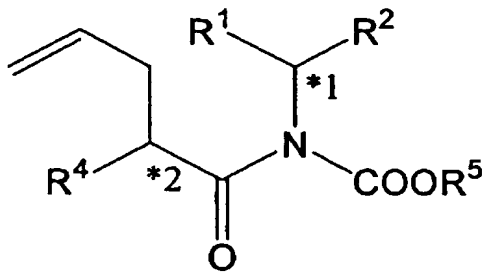
indicates that the carbon atom marked therewith is an asymmetric carbon atom;

with an organometallic compound and then further with a compound represented by the formula;

$ClCOOR^5$

wherein R^5 represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms;

to give a 2-allylcarboxamide derivative represented by the following formula (3);



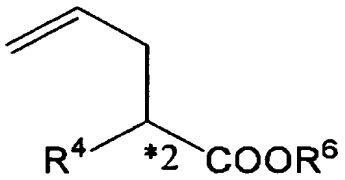
(3)

wherein R^1, R^2, R^4, R^5, *1 and *2 are as defined above;,

(b) reacting the derivative (3) with a compound represented by the formula MOR^6

wherein M represents an alkali metal and R^6 represents a substituted or unsubstituted alkyl group containing 1 to 20 carbon atoms

to give a 2-allylcarboxylic acid ester derivative represented by the following formula (4);



(4)

wherein R^4, R^6 and *2 are as defined above;,

and

(c) further hydrolyzing the derivative (4).

14. The process according to Claim 13, wherein an organomagnesium compound is used as the organometallic compound.

15. The process according to Claim 14, wherein a tert-butylmagnesium halide is used as the organomagnesium compound.

16. The process according to Claim 15, wherein tert-butylmagnesium chloride is used as the tert-butylmagnesium halide.

17. The process according to any one of Claims 13 to 16, wherein R^5 is phenyl group.

18. The process according to any one of Claims 13 to 16, wherein R^5 is isopropyl group.

19. The process according to any one of Claims 13 to 18, wherein M is a sodium atom.

20. The process according to any one of Claims 13 to 19, wherein R^6 is methyl group.

21. The process according to any one of Claims 13 to 20, wherein the step (b) is carried out in the presence of not less than 1.0 mole, per mole of the compound represented by the formula (3), of R^6OH.

22. The process according to any one of Claims 13 to 21,

wherein the compound represented by the formula (2) is in an optically active form.

23. The process according to any one of Claims 13 to 22,

wherein the hydrolysis in step (c) is carried out using an enzyme source capable of causing asymmetric hydrolysis.

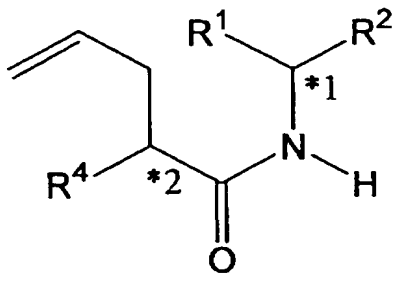
24. The process according to Claims 23,

wherein the enzyme source is an enzyme source derived from a microorganism belonging to the genus Candida, Humicola, Mucor, Pseudomonas, Rhizopus, Brevundimonas, Cellulomonas, Jensenia, Rhodococcus, Saccharomycopsis or Trichosporon.

25. The process according to Claims 23,

wherein the enzyme source is an enzyme source derived from Candida antarctica, Candida lipolitica, Candida cylindracea, Candida rugosa, Humicola sp., Humicola lanuginosa, Mucor meihei, Mucor javanicus, Pseudomonas sp., Rhizopus delemar, Rhizopus javanicus, Brevundimonas diminuta, Cellulomonas fimi, Jensenia canicruria, Rhodococcus erythropolis, Candida pini, Saccharomycopsis selenospora, Trichosporon cutaneum or Trichosporon debeurmannianum.

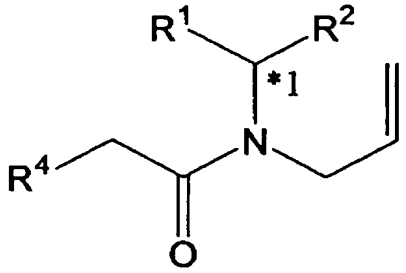
26. A process for producing a 2-allylcarboxamide derivative represented by the following formula (6);



(6)

wherein R^1, R^2 and R^4 each independently represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms and *1 and *2 each indicates that the carbon atom marked therewith is an asymmetric carbon atom;,

which comprises reacting a carboxamide compound represented by the following formula (2)



(2)

wherein R^1, R^2, R^4 and *1 are as defined above;
with an organometallic compound.

27. The process according to Claims 26,
wherein the compound represented by the formula (2) is in an optically active form.

28. The process according to Claim 26 or 27,
wherein an organomagnesium compound is used as the organometallic compound.

29. The process according to Claim 28,

wherein a tert-butylmagnesium halide is used as the organomagnesium compound.

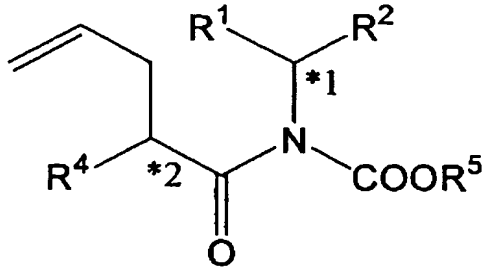
30. The process according to Claim 29,

wherein tert-butylmagnesium chloride is used as the tert-butylmagnesium halide.

31. The process according to any one of Claims 26 to 30,

wherein the compound represented by the formula (6) is recrystallized from a solvent to increase the diastereomeric excess thereof.

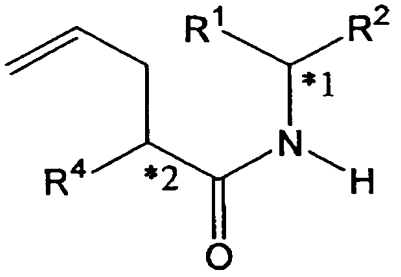
32. A process for producing a 2-allylcarboxamide derivative represented by the following formula (3);



(3)

wherein R^1, R^2, R^4 and R^5 each independently represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms, and *1 and *2 each indicates that the carbon atom marked therewith is an asymmetric carbon atom;

which comprises reacting a compound represented by the following formula (6);



(6)

wherein R^1, R^2, R^4, *1 and *2 are as defined above;
in the presence of a base and further with a compound represented by the formula;
$ClCOOR^5$
wherein R^5 is as defined above.

33. The process according to Claim 32,
wherein an alkali metal compound or an alkaline earth metal compound is used as the base.

34. The process according to Claim 33,
wherein sodium hydride is used as the alkali metal compound.

35. The process according to Claim 33,
wherein an organomagnesium compound is used as the alkaline earth metal compound.

36. The process according to Claim 35,
wherein a tert-butylmagnesium halide is used as the organomagnesium compound.

37. The process according to Claim 36,
wherein tert-butylmagnesium chloride is used as the tert-butylmagnesium halide.

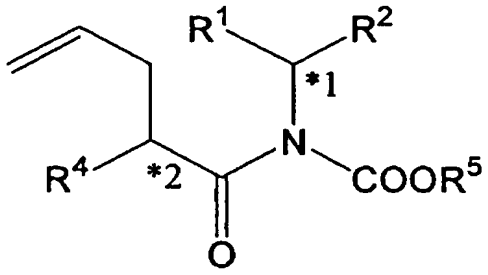
38. The process according to any one of Claims 32 to 37,

wherein R^5 is phenyl group.

39. The process according to any one of Claims 32 to 37,

wherein R^5 is isopropyl group.

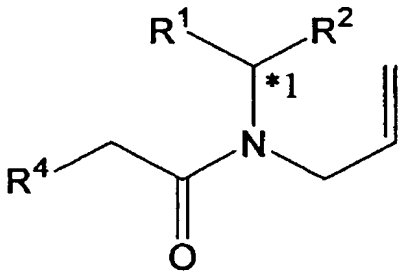
40. A process for producing a 2-allylcarboxamide derivative represented by the following formula (3);



(3)

wherein R^1, R^2, R^4 and R^5 each independently represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms, and *1 and *2 each indicates that the carbon atom marked therewith is an asymmetric carbon atom;

which comprises reacting a carboxamide compound represented by the following formula (2);



(2)

wherein R^1, R^2, R^4 and *1 are as defined above;
with an organometallic compound and further with a compound represented by the formula;
$ClCOOR^5$
wherein R^5 is as defined above.

41. The process according to Claim 40,
wherein an organomagnesium compound is used as the organometallic compound.

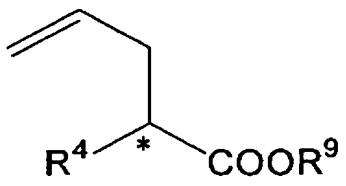
42. The process according to Claim 41,
wherein a tert-butylmagnesium halide is used as the organomagnesium compound.

43. The process according to Claim 42,
wherein tert-butylmagnesium chloride is used as the tert-butylmagnesium halide.

44. The process according to any one of Claims 40 to 43,
wherein R^5 is phenyl group.

45. The process according to any one of Claims 40 to 43,
wherein R^5 is isopropyl group.

46. A process for producing a 2-allylcarboxylic acid represented by the following formula (8);



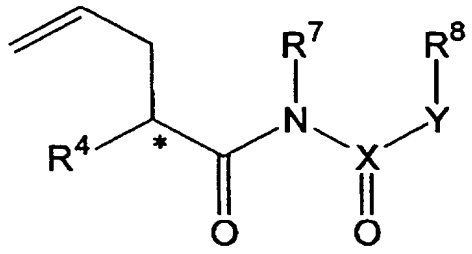
(8)

wherein R^4 represents a substituted or unsubstituted alkyl group

containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms, R^9 represents a hydrogen atom or a substituted or unsubstituted alkyl group containing 1 to 20 carbon atoms, and * indicates that the carbon atom marked therewith is an asymmetric carbon atom

or an ester derivative thereof;,

which comprises reacting a 2-allylcarboxamide derivative represented by the following formula (7);



(7)

wherein R^4 is as defined hereinabove, R^7 and R^8 each represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms and R^7 and R^8 may be bound together to form a ring, X represents C, S or S(O), Y represents CH, O or NH and * is as defined hereinabove;

with a compound represented by the formula MOR^9

wherein M represents an alkali metal and R^9 is as defined hereinabove

and,

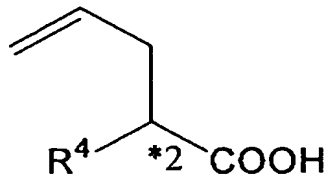
if necessary, hydrolyzing the resulting ester.

47. The process according to Claim 46,

wherein M is a sodium atom.

48. The process according to Claim 46 or 47, wherein R^9 is methyl group.

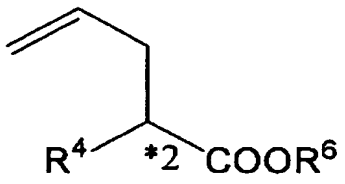
49. A process for producing an optically active 2-allylcarboxylic acid represented by the following formula (5);



(5)

wherein R^4 represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms, and *2 indicates that the carbon atom marked therewith is an asymmetric carbon atom;

which comprises causing an enzyme source having asymmetric hydrolysis activity to act on a 2-allylcarboxylic acid ester derivative represented by the following formula (4);



(4)

wherein R^4 is as defined hereinabove, R^6 represents a substituted or unsubstituted alkyl group containing 1 to 20 carbon atoms, and *2 is as defined hereinabove;
and

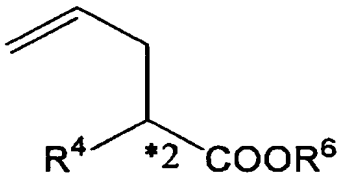
collecting the resulting optically active 2-allylcarboxylic acid.

50. The process according to Claim 49, wherein the compound represented by the formula (4) is

in a racemic form.

51. The process according to Claim 49,
wherein the compound represented by the formula (4) is in an optically active form.

52. A process for producing an optically active 2-allylcarboxylic acid ester represented by the following formula (4);



(4)

wherein R^4 represents a substituted or unsubstituted alkyl group containing 1 to 18 carbon atoms, a substituted or unsubstituted aryl group containing 6 to 20 carbon atoms or a substituted or unsubstituted aralkyl group containing 7 to 20 carbon atoms, R^6 represents a substituted or unsubstituted alkyl group containing 1 to 20 carbon atoms, and *2 indicates that the carbon atom marked therewith is an asymmetric carbon atom;
which comprises causing an enzyme source having asymmetric hydrolysis activity to act on a 2-allylcarboxylic acid ester derivative represented by the formula (4) given above and
collecting the unreacted optically active 2-allylcarboxylic acid ester.

53. The process according to Claim 52,
wherein the compound represented by the formula (4) is in a racemic form.

54. The process according to Claim 52,
wherein the compound represented by the formula (4) is in an optically active form.

55. The process according to any one of Claims 49 to 54,

wherein R^6 is methyl group or ethyl group.

56. The process according to any one of Claims 49 to 55,

wherein the enzyme is an enzyme source derived from a microorganism belonging to the genus Candida, Humicola, Mucor, Pseudomonas, Rhizopus, Brevundimonas, Cellulomonas, Jensenia, Rhodococcus, Saccharomycopsis or Trichosporon.

57. The process according to any one of Claims 49 to 55,

wherein the enzyme source is an enzyme source derived from Candida antarctica, Candida lipolitica, Candida cylindracea, Candida rugosa, Humicola sp., Humicola lanuginosa, Mucor meihei, Mucor javanicus, Pseudomonas sp., Rhizopus delemar, Rhizopus javanicus, Brevundimonas diminuta, Cellulomonas fimi, Jensenia canicruria, Rhodococcus erythropolis, Candida pini, Saccharomycopsis selenospora, Trichosporon cutaneum or Trichosporon debeurmannianum.